APPENDIX E: ALTERNATIVES EVALUATION SAMPLE WORKSHEETS

This appendix presents an alternatives evaluation conducted by a small company. The Significant Environmental Aspect (SEA) they identified was chemical hazard to workers from a solvent.

SCREEN ROOM COST IMPROVEMENT PLAN

Summary: A significant cost savings opportunity exists in our Screen Room operations by changing the method we use chemicals and also the vendor. Estimated yearly savings are $40,000. This is attain by replacing the Brand A "Cleaner" and Brand B Cleaner" with Brand C Cleaner and replacing the Brand B "Stencil Remover" with Brand C "Stencil Remover". The biggest $ impact is the difference in price and yield of Brand C "Stencil Remover". The price is $45/gal. compared to $85/gal. and the yield is estimated to be twice as much. The increase in yield is a direct result of not using the Brand A "Cleaner".

Brand C Cleaner is non-hazardous. It contains no cyclohexanone, xylene or glycol ether. The flash point is 122F. Brand A Cleaner is considered a hazardous chemical. It contains cyslohexanone and ethylbenzene, which the state of California has determined to cause cancer. The flash point is 50F.

It has been an ongoing goal to eliminate the need of Brand A "Cleaner" because of safety concerns. This proposal accomplishes this and attains a significant cost saving.

COST SAVINGS DETAILS – Sheet Fed Operation

There are several steps performed in the Screen Room that use the above chemicals as well as others. The following will be a comparison of present methods to the proposed methods highlighting usage, time required in the process, and noting potential savings in chemical and labor costs.

All Savings are based on 50 screens/day cycling through the Screen Room:

Initial Screen Cleaning after removing from printing press:

Present Method

I. Spray 2 oz. Of Brand B Cleaner onto the ink side of screen
II. Squeegee off ink into small bucket below screen
III. Repeat steps 1 and 2
IV. Wipe with cloth rag saturated with 3 oz. of Brand A "Cleaner". Repeats this operation an average of 3 times
V. Wipes with dry rag
VI. Total time: an average 5.5 minutes (This depends on UV or Solvent ink used or whether black ink was used)

Proposed Method

I. Spray 1 oz. of Brand C Cleaner onto the ink side of screen
II. Squeegee off ink into small bucket below screen
III. Repeat steps 1 and 2
IV. Spray 1 oz. of Brand C Cleaner on cloth rag and wipe clean
V. Total time: an average of 4 minutes

Cost Comparison

I. Cost Elements:
   1. Brand B Cleaner - $800/55gals. or .114/oz.
   2. Brand A Cleaner - $590/55gals. or .084/oz.
   3. Brand C Cleaner - $735/55gals. or .104/oz.

II. Present Method:
   1. 4 oz. of Brand B Cleaner - $ .456
   2. 9 oz. of Brand A Cleaner - .756
   Total Chemical Cost -$1.21

III. Proposed Method:
   1. 3 oz. of Brand C Cleaner - $ .315
   Total Chemical Cost - $ .315

IV. Yearly Chemical Savings:
   50 screens/day X 250 workdays/year X $.895 savings/screen = **$11,188**

V. Yearly Labor Savings:
   50 screens/day X 250 work days/year X 1.5 minute savings/screen / 60min./hour X $10/hour = **$3,125**

Reclaiming Process for Screens. Of the 50 screens that cycle through the Screen Room, only 30 (est.) screens go through this additional step to remove the emulsion.

Present Method

I. Spray 5 oz. of Brand C Product 1 on both sides
II. Power Rinse w/water – 1 side
III. Spray both sides with Brand B Product 2 -90oz.
IV. Power rinse with water – 1 side
V. Brush with Brand C Product 3 – both sides-1.4oz.
VI. 10 minutes queue time so #V will work
VII. Power rinse with water – 1 side
VIII. Move to Rinse tank
IX. Total time: an average of 8 minutes

Proposed Method

I. Spray 5 oz. of Brand C Product 1 on both sides
II. Power rinse w/water – 1 side
III. Spray with Brand C Product 2 – 1 side-45oz.
IV. Power rinse w/water – 1 side
V. A) 25 % of screens: Brush with Brand C Product 3 – both sides-1.4oz.
B) 75% of screens: Wipe with cloth rag saturated with Brand C Product 4 2 sides-2oz.: Go to step VIII**
VI. 25% of screens: 10 minute queue time so #VA will work
VII. 25% of screens: Power rinse w/ water – 1 side
VIII. Move to Rinse tank
IX. Total time: an average 6 minutes

****This is possible because of the elimination of Brand A Cleaner" which locks the image into the mesh. Brand C Product 3 will only be needed on dark colors, part. black.****

Cost Comparison

I. Cost Elements:
1. Brand C Product 1 - $1,045/55gals. Or .148/oz.
2. Brand B Product 1 - $85/gal. (4 gals. Are mixed with 51 gals. Of water) or .012/oz. of blen
3. Brand C Product 2 - $45/gal. (2 gals. Are mixed with 53gals. Of water) or .006/oz. of blend
4. Brand C Product 3 - $175/5gals. Or.273/oz
5. Brand C Product 4 - $42/5gals. (1 quart is mixed with 5 gals. Of water) or .003/oz. of blend

II. Present Method:
1. 5 oz. of Brand C Product 1 - $ .740
2. 90 oz. of Brand B Product 1 - 1.126

3. 1.4 oz. of Brand C Product 3 - .388
Total Chemical Cost $2.25

II. Proposed Method:
1. 5 oz. of Brand C Product 1 - $ .740
2. 45 oz. of Brand C Product 2 .270
3. 25% of screens: 1.4 oz. of Brand C Product 3 .388
75% of screens: 2 oz. of Brand C Product 4 .022
Total Chemical Cost $1.40 to $1.03

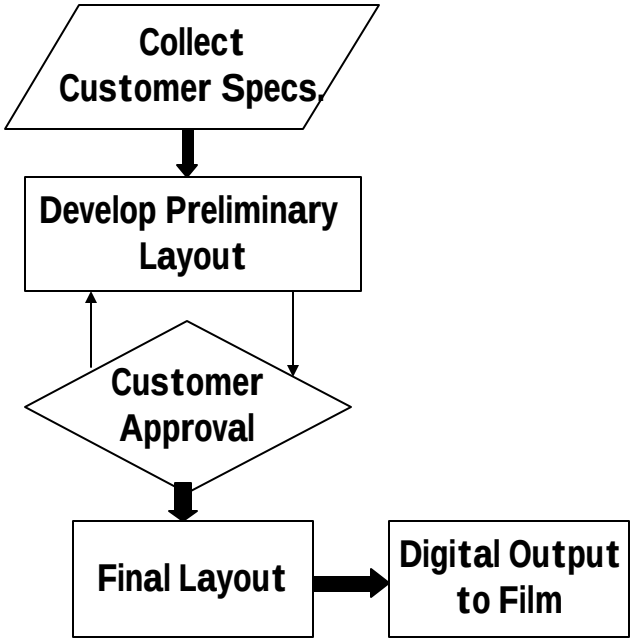
III. Yearly Chemical Savings:
12.5 screens/day(25% of total) X 250 workdays/year X $.85 savings/screen + 38.5 screens/day(75% of total) X 250 workdays/year X $1.22 savings/screen = **$14,398**

IV. Yearly Labor Savings:
30 screens/day X 250 workdays/year X 2 minutes savings/screen / 60min./hour X $10/hour= **$2,500**

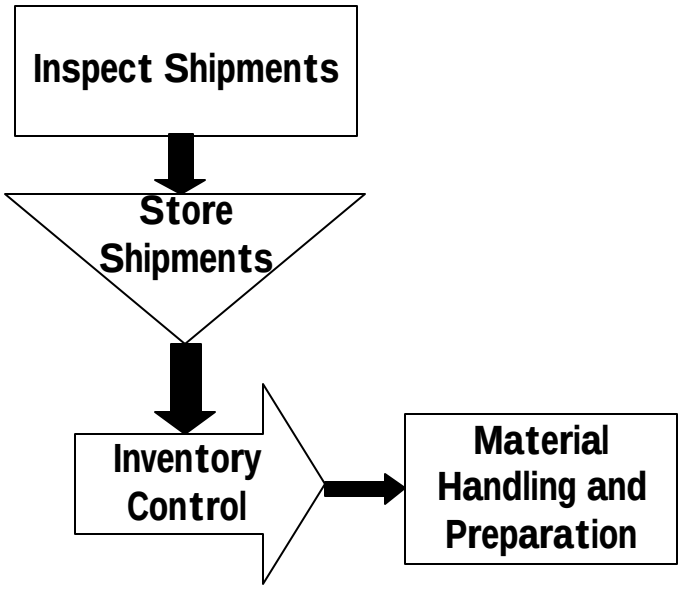
YEARLY SAVINGS IN SCREEN OPERATIONS:

CHEMICAL SAVINGS = $25,586
LABOR SAVINGS = 5,625
TOTAL $31,211

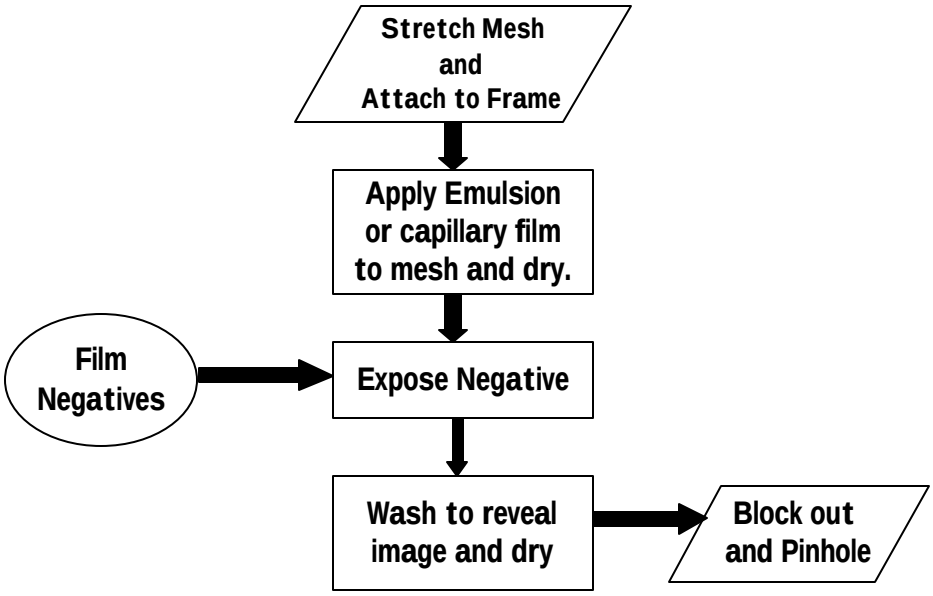
DESIGN ART



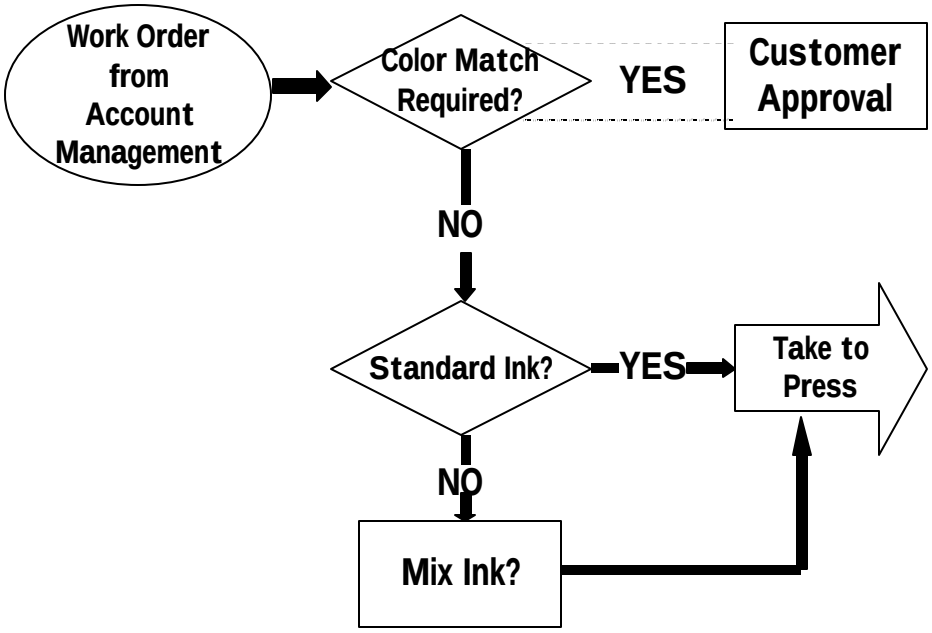
RECEIVE MATERIALS

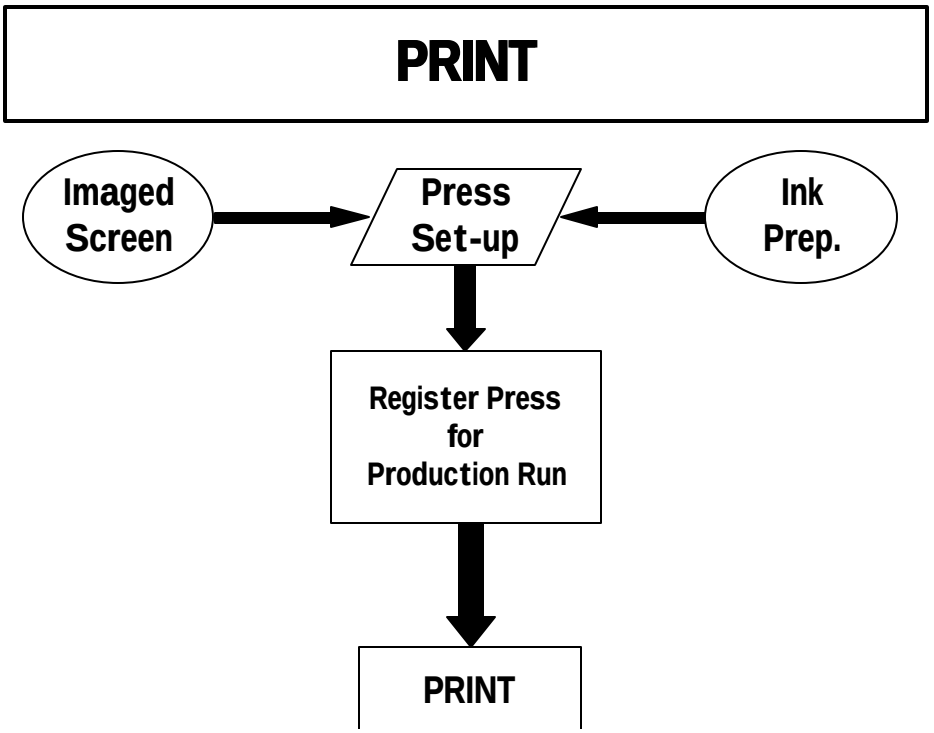


PREPARE EMULSION AND SCREEN



INK PREPARATION





INPUT/OUTPUT SUMMARY

NC Process Flow Maps

RECEIVE MATERIALS

I Store Shipment

Inputs
- Energy
- Building Space
- Safe Storage
- Recordkeeping

Outputs
- Leaking Containers
- Waste Products
- Spills (?)

II Inventory Control

Inputs
- Energy
- Recordkeeping

Outputs
- Expired Products
- Waste Products

III Material Handling & Preparation

Inputs
- Energy
- Recordkeeping

Outputs
- Empty containers

DESIGN ART

I. Collect Customer Specifications

Inputs
- Energy
- Paperwork

Outputs
- Unusable Artwork
- Waste Packaging Materials

II. Develop Preliminary Layout

Inputs
- Energy
- Paperwork
- Proofing Materials

Outputs
- Spent Printer Toner (cartridge)
- Paper
- Unusable Artwork
- Waste Packaging

III. Customer Approval

Inputs
- Energy
- Paperwork

IV. Final Layout

Inputs
- Energy
- Paperwork

V. Digital Output to Film

Inputs
- Energy
- Paperwork
- Film Stock
- Imaging Device
- Imaging Material

Outputs
- Spent Imaging Materials
- Waste Film

PREPARE EMULSION AND SCREEN

I Stretch Mesh & Attach to Frame

Inputs

- ☺ Frame
- ☐ Mesh
- ☐ Adhesive
- ☐ Energy
- ☐ Paperwork

Outputs

- ☐ Minimal Air Emissions
- ☐ Waste Adhesive
- ☐ Waste Mesh
- ☐ Waste Frame (potential)
- ☐ Used Razorblades

II Apply Emulsion or Capillary Film to Mesh and Dry

Inputs

- ☐ Energy
- ☐ Paperwork
- ☐ Activator
- ☐ Film or Emulsion
- ☐ Water

Outputs

- ☐ Expired Emulsion
- ☐ Waste Emulsion
- ☐ Waste Activator

III Expose Negative

Inputs

- ☐ Energy
- ☐ Paperwork
- ☐ Film Positive (or negative)
- ☐ UV Bulbs

Outputs

- ☐ UV Bulbs
- ☐ Film

IV Wash to Reveal Image & Dry

Inputs

- ☐ Energy
- ☐ Water
- ☐ Light Bulbs

Outputs

- ☐ Waste Water
- ☐ Used Light Bulbs

V Blockout & Pinhole

Inputs

- ☐ Energy
- ☐ Paperwork
- ☐ Blockout
- ☐ Water
- ☐ Tape

Outputs

- ☐ Waste Water
- ☐ Waste Blockout
- ☐ Waste Blockout Applicator
- ☐ Expired Materials

INK PREPARATION

I. Color Match Approval

Inputs

- ☐ Energy
- ☐ Paperwork
- ☐ Ink
- ☐ Substrate
- ☐ Containers
- ☐ Solvents
- ☐ Additives
- ☐ Mesh
- ☐ UV Bulbs

Outputs

- ☐ Waste Ink
- ☐ Mixing Sticks
- ☐ Empty Containers
- ☐ Color Proofing
- ☐ Substrate
- ☐ Used Shop Rags
- ☐ Waste Mesh (potential)
- ☐ Waste Frame (potential)

II. Mix Ink

Inputs

- ☐ Energy
- ☐ Paperwork
- ☐ Containers
- ☐ Substrate
- ☐ Solvents
- ☐ Ink
- ☐ Ink Additives

Outputs

- ☐ Waste Ink
- ☐ Waste Ink Additives
- ☐ Empty Containers
- ☐ Substrate
- ☐ Mixing Sticks
- ☐ Used Shop Rags

PRINT

I Press Set-up

Inputs

- Energy
- Paperwork

Outputs

- Used Shop Rags

II Register Press For Production Run

Inputs

- Shop Rags
- Additives
- Solvents
- Paperwork
- Energy
- Substrate
- Ink

Outputs

- Used Shop Towels
- Tape
- Setup Paper
- Waste Substrate
- Waste Ink

III Print

Inputs

- Energy
- Shop Rags
- Paperwork
- Solvents
- Additives
- Substrate
- Ink
- Coatings
- Adhesives

Outputs

- Used Shop Rags
- Waste Inks
- Waste Solvent
- Spills (possible)
- Used Ink Containers
- Tape

SCREEN RECLAIMING

I Apply Ink Remover

Inputs
- Solvent
- Shop Rags
- Squeegee
- Ink Remover
- Storage Container

Outputs
- Used Shop Rags
- Waste Ink
- Spills (possible)

II Rinse

Inputs
- Energy
- Water

Outputs
- Waste Water

III Remove Emulsion or Capillary Film

Inputs
- Energy
- Shop Rags
- Water
- Stencil Remover
- Scrubbers

Outputs
- Waster Water
- Tape
- Used Shop Rags
- Spills (possible)

IV Rinse

Inputs
- Energy
- Water

Outputs
- Waste Water

V Remove Haze

Inputs
- Energy
- Water
- Haze Remover
- Scrubbers

Outputs
- Waster Water
- Used Shop Rags
- Spills (possible)

VI Rinse

Inputs
- Energy
- Water

Outputs
- Waste Water

VII Dry

Inputs
- Energy

FINISHING, PACKAGING, & SHIPPING

I. Finishing Activities

Inputs

- Paperwork
- Energy
- Finishing Materials
- Finishing Tools
- Tape

Outputs

- Waste Material
- Trimmings
- Adhesive
- Spent Finishing Materials
- Spent Finishing Tools

II. Packaging Activities

Inputs

- Energy
- Paperwork
- Pallets
- Boxes
- Packing Materials

Outputs

- Broken Containers
- Packaging Waste

III. Shipping Activities

Inputs

- Transportation
- Energy
- Paperwork

Outputs

- Refused Product
- Transportation Emissions

SIGNIFICANT ENVIRONMENTAL ASPECTS (SEAs)

1) Reduce VOCs

2) Contain lead contamination (water table)

3) Employee health and safety

Worksheet 8-1: Functions and Alternatives

Aspect	Alternative Products	Alternative Technologies	Alternative Work Practices	Recycling/ Reuse	Treatment	Disposal
Baseline	Screen cleaner/ ink remover					
Function	screen reuse / ink remover					
	Brand C Cleaner					
	Brand D Cleaner	Auto screen washer				

Date Completed: _____ Contact Person: _____

Worksheet 8-2: Alternative Products Environmental Effects Comparison

Chemical Product	Known Effects[1]	Management of Effects[2]	Cost of Mgmt.[3]	Resource use	Effects Score
Baseline	Cancer Hi F.P. Odor	gloves		NA	
Brand C Cleaner	Skin irritation	gloves exhaust fan	same	NA	
Brand D Cleaner		gloves exhaust fan	same	NA	

Notes:

[1] Return to the "Environmental Concerns Worksheet" in Module 5 for the "known effects."

[2] List protection required for each effect.

[3] Identify cost items.

Worksheet 8-3: Performance Comparison of Alternatives					
	how well does it work	how long does it take		how easy is it to use	total
		Qty*	Time		
Baseline Brand A cleaner	visual check	90t.	5½ min.		
Brand C cleaner	" work better	30t.	4 min.	easier/faster	
Brand D cleaner	" work better	30t.	4min.	easier / faster	

*Qty / screen

Worksheet 8-4: Regulatory Comparison of Alternatives				
	Regulations Required (list)	Controls Required (list)	Cost of Regulations	Total
Brand A cleaner	RCRA - fine. CAA - Air, VOC			
Brand C cleaner	Same now; better in future (< VOC)		Better; less Qty	
Brand D cleaner	Same now; better if future (<VOC)		Better; less Qty	

Worksheet 8-5: Cost Comparison of Alternatives						
	raw material	labor	disposal	total cost	savings [1]	net cost
Brand A cleaner	$590/ 55gal	5½ min	—			
Brand C cleaner	$735/ 55gal	4 min	less		25,520/yr - in $ 5,700/yr - labor	
Brand D cleaner	$920/ 55gal	4 min	less			

$25,520/yr savings

$5700/yr in labor

fewer shop towels

Worksheet 8-6: Alternative Products Evaluation Worksheet					
Chemical Product	Performance	Regulations	Cost	Effects[1] Score	Overall Score[2]
Brand A	—	—	—	—	
Brand C	+	+	++	+	
Brand D	+	+	+	++	

Date Completed: _____ Contact Person: _____

[1] Take score from Environmental Effects Comparison Table above (last column).

[2] Score on a scale of low to high to reflect the desirability of each product. This is a judgment call.